(12) UK Patent Application (19) GB (11) 2 037 223 A

(21) Application No 7940590
(22) Date of filing 23 Nov 1979
(30) Priority data
(31) 2851487
(32) 28 Nov 1978
(33) Fed. Rep of Germany (DE)
(43) Application published
9 Jul 1980
(51) INT CL³
B28D 1/22
(52) Domestic classification
B5E 10X
(56) Documents cited
GB 1239593
GB 1239592
(58) Field of search
B5E
E1G
(71) Applicants
Reinhard Wirtgen,
Hohner Strabe 2,
5461 Windhagen,
Federal Republic of
Germany.
(72) Inventors
Reinhard Wirtgen
(74) Agents
Fitzpatricks

(54) **Milling cutter for a milling device**

(57) The invention relates to a milling cutter for a milling device, particularly for milling road surfaces, comprising a shaft 19 of circular diameter, which is so shaped at one end that it may detachably be inserted into a holder on said milling device and includes a cutter tip 26 of hard metal material within a concentric opening at the other end thereof, wherein said shaft is provided, at least within the range of said cutter tip, with a collar 28 of wear-resistant material.

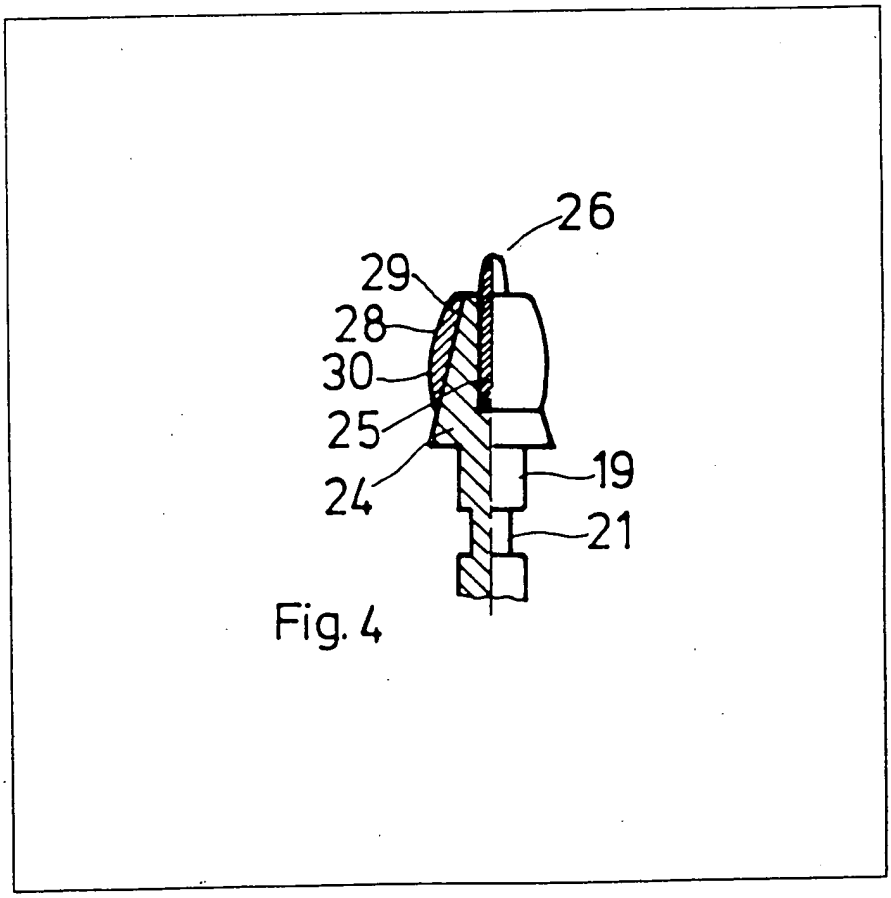


Fig. 4

GB 2 037 223 A

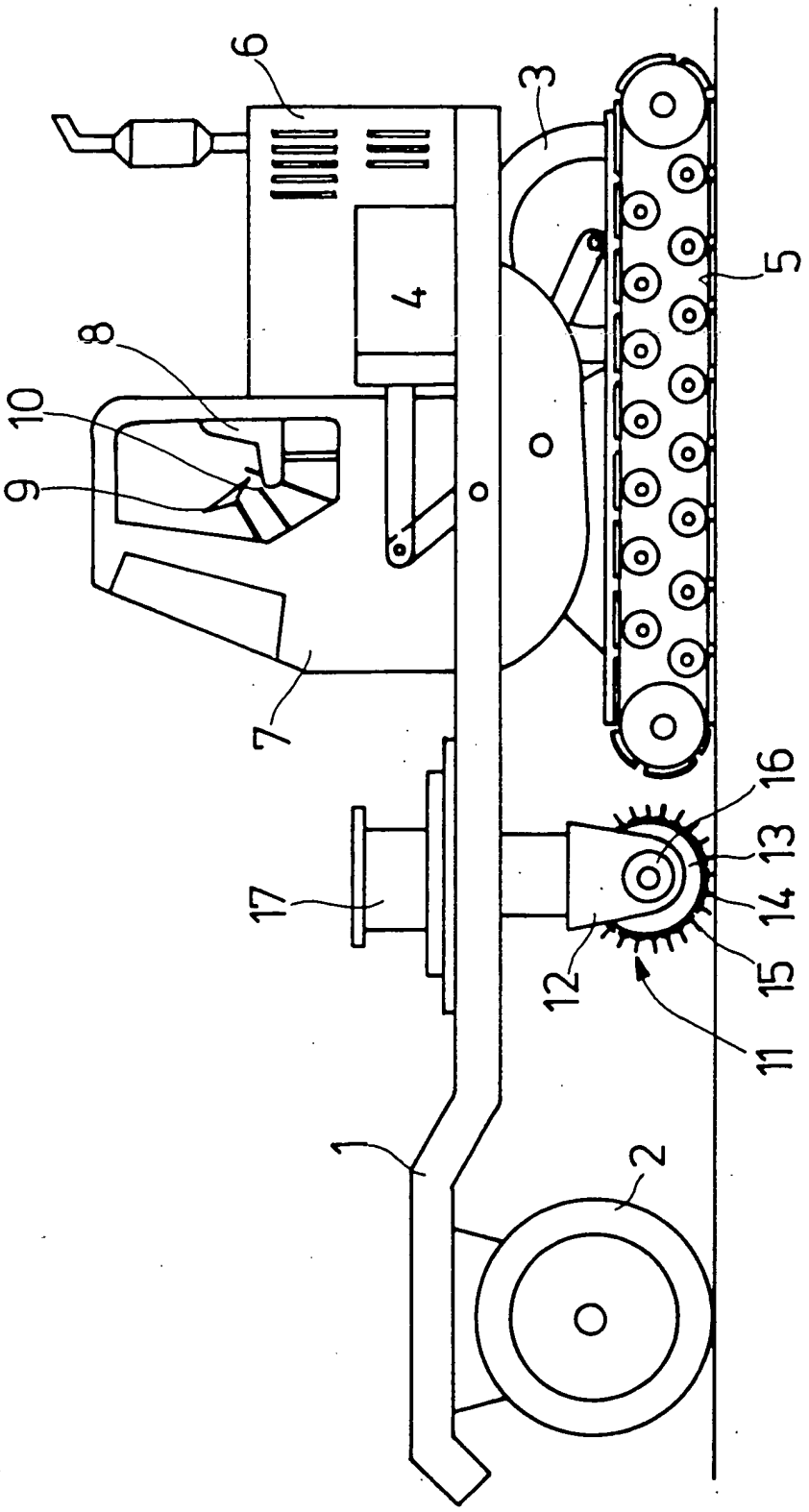
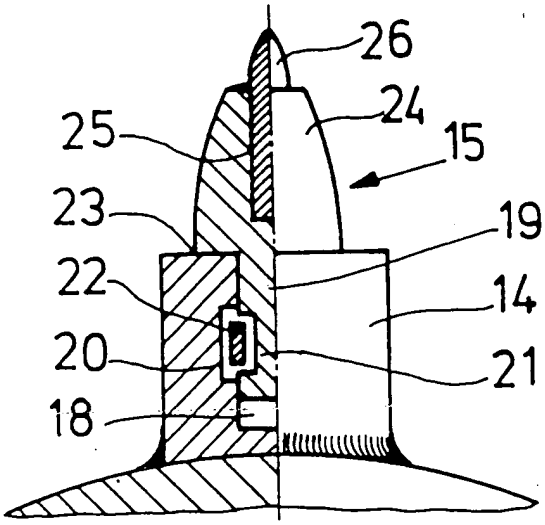


Fig. 1

Fig. 2



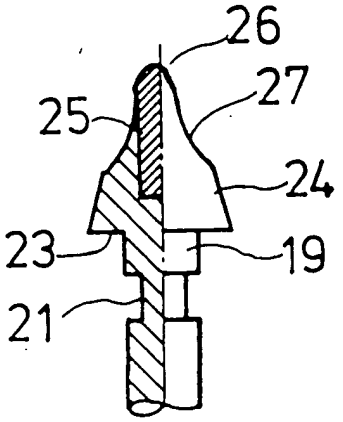


Fig. 3

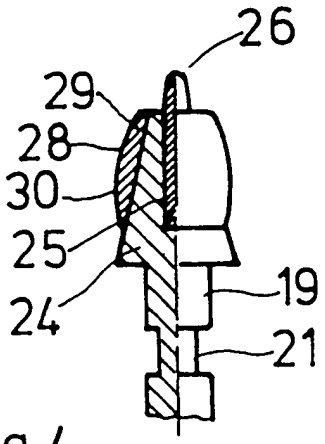


Fig. 4

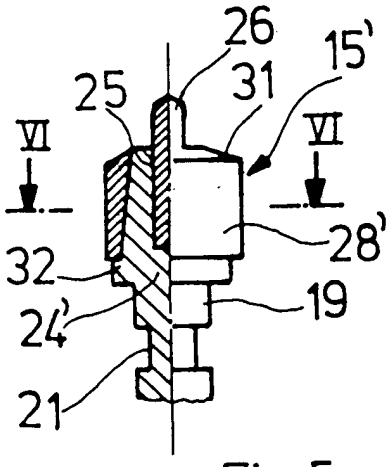


Fig. 5

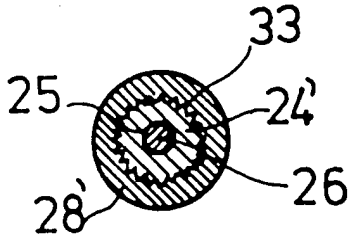


Fig. 6

SPECIFICATION

Milling cutter for a milling device

The invention relates to a milling cutter for a milling device particularly for milling road surfaces comprising a shaft of circular diameter, which is so shaped at one end that it may detachably be inserted into a holder on the milling device and includes a cutter tip of hard-metal material within a concentric opening at the other end thereof.

Prior art milling cutters of this kind generally comprise a shaft from a cheap and easily machinable material, such as for instance gray cast iron, which is provided at one of its ends with an annular groove for a snap ring cooperating with a further annular groove in the holder for the milling cutter. The holder is arranged together with a plurality of further holders for other milling cutters on a milling roller which is connected to a drive motor and rotates, during the course of the milling process, together with, or contrary to, as the case may be, the milling direction. The fixation of the milling cutter in the holder with the aid of a snap ring permits an easy and rapid exchange of a worn or damaged milling cutter against a new one.

At the end averted from the annular groove, the prior art milling cutter is provided with a concentric hole into which a bolt-like milling cutter of hard-metal material is inserted. The milling cutter terminating at the front side thereof in a tip is generally kept in the shaft hole by means of a hard-solder bond. When the cutter tip is worn after a number of milling hours, the hard-solder bond is softened by heating the shaft, the cutter tip is withdrawn, and a new cutter tip is inserted.

Although the cutter tip protrudes substantially from the shaft and although it will already be replaced when its free end still protrudes for several millimeters from the shaft hole, there is nevertheless a substantial wear also on the shaft; particularly in the range of the cutter tip the shaft material is abraded and worn off by the milled away material with the consequence that the wall thickness of the hole receiving the cutter tip becomes thinner and thinner and finally becomes so weak that the cutter tip will break away even under little stress and the shaft is irreparably damaged. If relatively hard road surfaces are removed, such damage may already be experienced when two milling heads have been used up. Considering however that, depending on the size, each milling roller may hold up to one thousand milling cutters, it is well understood that such a shaft consumption will considerably increase the costs per milled-off road length unit.

Although this disadvantage could be eliminated in that the shaft of the milling cutter is produced from a wear-resistant material, the shaft would become so expensive as compared to the known shafts that the employment of the known milling cutters is cheaper in the end.

It is now the aim of the invention to provide a milling cutter, which has a long life and is cheap in production.

This aim is solved in accordance with the invention in that the shaft is provided, at least within the range of the cutter tip, with a collar of wear-resistant material.

By this feature of the invention, the life of the milling cutter shaft is substantially increased, on one side, while the production costs are only insignificantly increased, on the other, namely for the material costs of the collar and for the mounting costs of the collar on the shaft. Particularly in cases where mounting of the collar is performed on a semi-automatic or fully-automatic machine, the mounting costs can be neglected. If finally the collar is replaced prior to its complete wear by another new collar, the life time of the shaft may furtheron considerably be extended.

It has shown to be suitable to produce the collar from a hard-metal material. As a material suitable for this purpose, a hard-metal alloy, such as stellite or celsite, should be considered but also a cast carbide, such as tungsten carbide or molybdenum carbide, may be used.

In accordance with an advantageous embodiment of the invention, the collar and the shaft are connected with one another by a hard-solder bond. Such a hard-solder bond has the advantage that a worn collar may easily and rapidly be exchanged against a new one. The area of the collar need only be heated and, when the hard-solder bond has softened, the worn collar has to be removed and the new one has to be inserted.

A further advantageous fixation of the collar on the shaft is made, in accordance with a further embodiment of the invention by a compressed fit connection. In this case, the collar is force-lockingly secured to the shaft, the height of the closed linkage being determined by the oversize between collar and shaft. In the simplest case, the compressed fit connection may be formed as a circular compressed fit connection. In this case, the collar is heated prior to its application and/or the shaft is cooled down so that the collar and the shaft may be joined without any particular force. When the collar has cooled down and/or the shaft has warmed up, the two portions are solidly locked with one another. Instead of this shrinkage connection, a compressed fit connection by means of a knurled head screw may be provided. In this case, a collar is provided, which comprises on its interior circumference uniformly distributed teeth, which are inwardly directed and longitudinally arranged and which, when pressing the collar onto the shaft, engrave into the softer shaft material. Instead of providing the knurls on the inner face of the collar, knurls arranged on the shaft surface may be provided as well. As the material of the collar however is harder than that of the shaft, the fixation of the collar on the shaft is less solid.

The stability of the bond between shaft and collar in case of a circular compressed fit connection may furtheron be increased by means of hard soldering of the two portions. The latter will be of particular interest in cases when for reasons of brittleness of the collar material the circular compressed fit connection may be designed only with a relatively small oversize between collar and shaft, which means that the connection may absorb only medium separation

forces.

A further advantageous possibility of securing the collar onto the shaft consists in bonding the collar and the shaft by means of a two-component adhesive. Such an embodiment may particularly be employed in connection with a circular compressed fit connection, as the separating forces then experienced need not be borne by the two-component adhesive alone. Such a connection is however nontheless also applicable with a two-component adhesive without an additional circular compressed fit connection particularly in cases when the milling cutter is to be used for milling asphalt road surfaces only.

A further prolongation of the life of the shaft-collar unit may be obtained, in accordance with a further advantageous embodiment of the invention, in that the collar has an outer surface, which is outwardly curved in the direction of the longitudinal axis. In other words, the collar is thicker in the area of maximum wear than in the places of less wear so that an exchange of the collar is substantially later necessary than is the case with a collar having a constant wall thickness.

To absorb the forces bearing in the direction of the longitudinal axis on the collar in the course of the milling process, it is advisable to provide the shaft with a shoulder as a support for the rear portion of the collar. A further advantageous possibility consists in providing the shaft in the area of the collar with a conical shape while the collar shows an inner bore adapted to this shape. Particularly in the latter case, it may furtheron be of advantage if the collar has a conically shaped outer surface, too. Otherwise there would be an unfavorable increase of the outer diameter of the shaft-collar unity in the area of the cutter tip leading to an increased resistance of passage of the milling cutter through the milled-off material with the consequence that the load of the drive motor of the milling roller increases considerably, and in some cases a stronger drive motor has to be provided.

The exemplified embodiments shown, partly in a schematic representation, in the accompanying drawings serve to further explain the invention. In the Figures:

Figure 1 is a side view of a machine for milling road surfaces including a milling roller equipped with a plurality of milling cutters.

Figure 2 is a side view, partly in cross section, of a prior art milling cutter in a holder on the milling roll.

Figure 3 is a side view, partly in cross section, of a prior art milling cutter after a number of milling operations.

Figure 4 is a side view, partly in cross section, of a milling cutter including a collar.

Figure 5 is a side view, partly in cross section, of another milling cutter including a collar, and

Figure 6 is a cross section through a milling cutter according to Figure 5 along the line VI-VI.

The machine shown in Figure 1 comprises a chassis 1 including a steerable and driven rubber-tired fron wheel pair 2 and a rubber-tired rear wheel pair 3, which is tiltingly mounted to the chassis and may be tilted by means of a hydraulic operation cylinder 4 from the idle position, as shown, into a travelling position when the chassis rests exclusively on the rubber-tired wheels. In the rear portion of chassis 1, there is furtheron arranged track pair 5, on which the rear portion of the chassis 1 rests during the milling operation.

The tilting arrangement of the rubber-tired rear wheel pair 3 and the additional provision of a track pair 5 make it possible that the machine may rapidly be moved on rubber-tired wheel pairs 2 and 3 from one place of operation to another while during milling operation the road surface may be milled with high precision and great propulsion.

In the rear portion of chassis, furtheron, the drive motor 6 and in front thereof cockpit 7, including the driver's seat 8, the steering wheel 9, and operating control levers 10 are provided.

In travelling direction, immediately in front of track pair 5, the milling system 11 is provided, which comprises a milling roller 13 which is supported in a bearing block 12. To the milling roller, there are welded a plurality of holders 14 for the milling cutters 15. The bearing block which carries also the hydraulic drive motor 16 for the milling roller is secured to chassis 1 and may be vertically adjusted by means of a hydraulic operating cylinder 17.

As may particularly be taken from Figure 2, each holder 14 includes a bore 18 to receive the shaft 19 of milling cutters 15. In the side wall of bore 18, there is an annular groove 20, which corresponds to a further annular groove 21 in shaft 19 of the milling cutter. In the annular groove 21, there is provided a snap ring 22, which snaps open after the introduction of the shaft 19 into the bore 18 and with part of its circumference extends into annular groove 20 so that the milling cutter is axially safely retained in the bore 18.

Shaft 19 becomes larger at the end averted from groove 21, forms a shoulder 23, and terminates in a cone. In this front portion 24, there is a bore 25 to receive a hard-metal pin-shaped cutter tip 26. The cutter tip 26 is secured in bore 25 by a hard-solder bond.

In the course of the milling of the road surface, which is solely performed by cutter tip 26, the front position 24, too, is ground and abraded by the passing milled-off material so that after a certain time the milling cutter has the shape as depicted in Figure 3. As may be seen, the cutter tip has become considerably shorter because of the abrasion and the side walls of the front portion 24 show an excavation 27. Because of this excavation 27, the wall thickness of the bore hole 25 is that much decreased that the cutter tip 26 will break away when strained and the front portion 24 is that much damaged that milling cutter 15 cannot be used any longer.

In order to avoid this disadvantage, the front portion 24 of the milling cutter is provided with a collar 28 of hard-metal material as shown in Figure 4. The collar 28 includes an inner bore 29 adapted to the conical shape of the front portion 24. Furtheron, it includes an outer surface 30 which is outwardly arched in the direction of the longitudinal axis, that is in the location where the greatest wear is experi-

enced it has a greater wall thickness than in the end portions. The collar 28 is solidly bonded to the front portion 24 by a hard-solder connection.

In Figures 5 and 6, a further embodiment of a milling cutter protected by a collar is shown. In this embodiment, the front portion 24' of milling cutter 15' is cylindrical. On this cylindrical portion, there is provided an identically cylindrical collar 28', which only on the front side thereof is provided with a bevel 31. At the rear portion thereof, the collar 28' is supported by a shoulder 32 provided on the front portion 24'. The collar 28' is provided at its inner side with a plurality of longitudinally arranged rib-shaped teeth 33 uniformly distributed over the periphery, which engrave, when inserting the collar 28' onto the cylindrical front portion 24', into the material of portion 24' and thus safeguard a safe fixation of collar 28' on front portion 24'. A further protection of this compressed fit connection by means of a knurled head screw against unwanted loosening of the two portions 24' and 28' may be obtained by providing a two-component adhesive between the two portions 24' and 28'.

CLAIMS

1. Milling cutter for a milling device particularly for milling road surfaces comprising a shaft of circular diameter, which is so shaped at one end that it may detachably be inserted into a holder on said milling device and includes a cutter tip of hard-metal material within a concentric opening at the other end thereof, wherein said shaft is provided, at least within the range of said cutter tip, with a collar of wear-resistant material.

2. Milling cutter according to claim 1, wherein said collar is made of a hard-metal material.

3. Milling cutter according to claim 1 or 2, wherein said collar and said shaft are connected with one another by a hard-solder bond.

4. Milling cutter according to one of claims 1 through 3, wherein said collar is secured to said shaft by a compressed fit connection.

5. Milling cutter according to claim 4, wherein a compressed circular fit connection is provided.

6. Milling cutter according to claim 4, wherein a compressed fit connection by means of a knurled head screw is provided.

7. Milling cutter according to one of claims 4 through 6, wherein said collar and said shaft are connected by a two-component adhesive.

8. Milling cutter according to one of claims 1 through 7, wherein said collar has an outer surface which is outwardly curved in the direction of the longitudinal axis.

9. Milling cutter according to one of claims 1 through 8, wherein said shaft is provided with a shoulder as a support for the rear portion of said collar.

10. Milling cutter according to one of claims 1 through 9, wherein said shaft includes within the range of said collar an inner bore adapted to the shape thereof.

11. Milling cutter according to claim 10, wherein said collar includes a conically shaped outer surface.

12. Milling cutter substancially as described with Reference to and as illustrated in the accompanying drawings.

Printed for Her Majesty's Stationery Office by Croydon Printing Company Limited, Croydon Surrey, 1980.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.